



California Regional Water Quality Control Board

Lahontan Region



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INVESTIGATIVE ORDER NO. R6V-2011-0053, TO SUBMIT REVISED MANGANESE MITIGATION PLAN FOR THE PG&E HINKLEY COMPRESSOR STATION, SAN BERNARDINO COUNTY—CLEANUP AND ABATEMENT ORDER NO. R6V-2008-0002

This letter requires PG&E to provide a revised manganese mitigation plan to the Water Board that proposes a means to reduce manganese plume migration in groundwater while still continuing to operate the Central Area In-Situ Remediation Zone (IRZ).

Background

On June 6, 2011, the Water Board received the document, "Manganese Mitigation Plan for the In-Situ Reactive Zone Project (Plan)." The Plan includes two proposals: a mitigation plan to off-set manganese plume migration from in-situ activities and a request to cease ethanol injections in the Central Area IRZ. The Plan was submitted in compliance with the Notice of Applicability of General Waste Discharge Requirements (General WDR), in Board Order No. R6V-2008-0014.

In response to exceedances of manganese concentrations at contingency monitoring wells (500 series), PG&E proposes to install an extraction well to pump out impacted groundwater and percolate it via dry wells or an infiltration gallery. This action should cause the oxidation of dissolved manganese (Mn[II]) to solid manganese (Mn[III/IV]), leaving a precipitant in soil. In addition, three new monitoring wells will be installed approximately 400 feet northwest of CA-MW-504, -505, and -506 to monitor Mn remediation in the downgradient flow direction. In order to reduce future manganese production, PG&E recommends eliminating ethanol injections to the Central Area IRZ. Residual reductive conditions currently existing in-situ in the Central Area will act to continue reducing hexavalent chromium in groundwater to solid trivalent chromium.

PG&E previously suspended ethanol injections in the eastern half of the Central Area while reducing conditions in soil continued to convert hexavalent chromium (Cr[VI]) to



trivalent chromium (Cr[III]). Now PG&E believes that injections in the western half are also not necessary due to low chromium concentrations in groundwater.

Comments on Manganese Mitigation

First, Water Board staff agree with PG&E that clean up efforts of chromium in groundwater at the Central Area IRZ are showing excellent results where treatment is occurring. Monitoring data shows that IRZ treatment has been able to reduce contaminants down to less than 1 ppb for total chromium and less than 0.2 ppb for hexavalent chromium. Of the byproducts observed, manganese poses the most problems with IRZ treatment.

Second, Water Board staff agrees that where manganese has migrated more than 2,000 ft from injection points, it is best to contain plume migration and limit additional manganese production in the upgradient flow direction. Thus, Water Board staff accepts the Plan for manganese mitigation and monitoring with the following conditions:

1. The location of the proposed extraction well should be moved slightly north so as to be in-line between wells CA-MW-505 and CA-MW-504, so as to achieve better capture of the northern extent of the manganese plume. Moving the extraction well to the suggested location will account for manganese migration since the beginning of 2011. This would put the extraction well about 75 feet north of the proposed location.
2. The proposed location for the dry wells/infiltration gallery, north of wells CA-MW-505 and 504 and south of proposed wells CA-MW-603, has the potential to push out the manganese plume in the east and west directions and interfere with monitoring by diluting water at proposed sentry well CA-MW-603. The dry well/infiltration gallery location needs be re-located upgradient of the extraction well.
3. A lysimeter needs to be installed below the depth of the dry wells/infiltration gallery to monitor the effectiveness of aerated groundwater for converting dissolved manganese [Mn (II)] to solid manganese [Mn(III/IV)].

Comments on Central Area IRZ Operation

Water Board staff has carefully considered PG&E's proposal to suspend ethanol injections to the entire Central Area IRZ. Data in the First Quarter 2011 Monitoring Report for IRZ indicates that up to 60 percent of the chromium plume is currently being treated.

Water Board staff agrees with PG&E that where IRZ treatment is effectively reducing chromium in groundwater out to the monitoring wells numbered in the 400 series, ethanol injections can cease for the time being. Doing so will reduce manganese production and migration. Thus, ethanol injections may cease in wells CA-RW-01, -02,

-03, -09, -10, and -11. When monitoring data indicates that reductive conditions are no longer present or that chromium is no longer being reduced significantly in concentration, injections must be re-started.

A portion of the chromium plume in the Central Area not receiving treatment includes a 90-foot wide strip in the middle. This strip is downgradient of ethanol injection wells CA-RW-06, -07, and -08. Monitoring well MW-06, located only 60 feet downgradient of these injection wells, contained hexavalent chromium at 125 ppb in February 2011 and has been essentially consistent in concentration over four quarters. Such information indicates that in-situ treatment is not reaching MW-06. The rest of the Central Area plume not receiving treatment are the eastern and western portions of the plume width.

Thus, Water Board staff does not agree that there is complete treatment of chromium in groundwater across the line of ethanol injection wells in the Central Area IRZ. Board staff believes that where IRZ treatment is less effective due to hydrogeologic conditions, active remediation needs to continue or be revised until chromium is reduced in groundwater out to the 400 series of monitoring wells. Thus, injections must continue in wells CA-RW-06, -07, and -08 or other revised locations to reduce chromium being detected in MW-06. Manganese poses little migration risk at these locations due to limited in-situ treatment occurring at injection points.

Finally, where IRZ treatment has not been implemented, Water Board staff believes PG&E needs to expand treatment operations so as to affect the entire width of the Central Area chromium plume. On the west side of the plume, hexavalent chromium is still being detected in well CA-MW-108 at concentrations up to 61 ppb and in well CA-MW-313 at 69 ppb. Both wells appear to be west of the influence of IRZ treatment, indicating that treatment needs to be expanded farther west. On the east side of the plume, hexavalent chromium is still being detected in well CA-MW-410 at concentrations of 24 ppb and in well CA-MW-411 at 59 ppb. Neither location shows evidence of being affected by in-situ treatment. Approximately 100 feet of chromium concentrations exceeding maximum background levels exists to the east. Sufficient distance exists along the east side to expand IRZ efforts and still maintain a buffer with Summerset Road.

When these non-treatment issues were raised in past meetings, PG&E told Water Board staff that in-situ activities being implemented in the SCRIA should also remediate untreated areas in the Central Area. However, review of data and maps in the First Quarter 2011 Monitoring Report for IRZ do not show adequate treatment occurring in these areas. Instead, in-situ treated areas within the SCRIA appear to overlap the same treated areas in the Central Area and do not extend to the western and eastern boundaries.

To summarize, rather than shut down IRZ treatment in the entire Central Area, Water Board staff requests that additional efforts be implemented to remediate chromium in the middle of the chromium plume and out to the western and eastern sides.

Requirements

According to the 2008 CAO, PG&E must actively conduct clean up actions in the Central Area IRZ to reduce hexavalent and total chromium concentrations in groundwater. IRZ active remediation must continue until PG&E proposes and the Water Board accepts an alternate but equally effective remedial action.

Pursuant to section 13267 of the California Water Code, PG&E is required to submit a technical report to the Water Board **by September 9, 2011**, containing a revised manganese mitigation plan containing the following information:

1. Discussion and map showing alternate locations for the extraction well and dry wells/infiltration gallery to remediate manganese concentrations in groundwater.
2. A proposed lysimeter to be installed beneath the dry wells/infiltration gallery to evaluate the effectiveness of manganese reduction in groundwater that percolates in the vadose zone. Include lysimeter designs and a monitoring program.
3. Propose triggers or conditions that will be used to evaluate when reductive processes are no longer effective in the Central Area IRZ at locations where ethanol injections have ceased.
4. A proposal to remediate untreated or poorly treated chromium in groundwater in the Central Area IRZ. The proposal should specifically address the middle portion of the plume and out to the western and eastern sides. Include an implementation schedule.
5. The stamp and signature of a state licensed civil engineer or geologist.

Please contact me at 542-5436 or Lisa Dernbach at (530) 542-5424, if you should have any questions.



LAURI KEMPER
ASSISTANT EXECUTIVE OFFICER

cc: PG&E Technical Mail List

LSD/clhT: PG&E Mn mitigation and CA plan 711
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